

IN THE CLAIMS

Please amend the claims as follows.

- 1 1. (Unamended) A system to automatically inspect an optical mask, said system comprising:
2 film coating system to apply a conductive coating to a top surface of said optical mask to
3 produce a conductive optical mask;
4 a grounding strap to connect said conductive coating of said conductive optical mask to
5 electrical ground;
6 a field emission electron source to provide an electron beam;
7 a charged particle beam column to deliver and scan said electron beam from said field
8 emission electron source on a top surface of said conductive coating;
9 a backscatter electron detector to detect backscattered electrons from said conductive
10 optical mask to generate a backscatter electron waveform as said electron beam
11 scans said conductive optical mask;
12 a secondary electron detector to detect secondary electrons from said conductive optical
13 mask to generate a secondary electron waveform as said electron beam scans said
14 conductive coating; and
15 a processor to examine said backscatter electron waveform and said secondary electron
16 waveform to determine construction features of said conductive optical mask.
- 1 2. (Unamended) A system to automatically inspect an optical mask as in claim 1 wherein
2 said optical mask is a phase shift mask.

1 3. (Unamended) A system to automatically inspect an optical mask as in claim 1 wherein
2 said film coating system is a sputtering system.

1 4. (Unamended) A system to automatically inspect an optical mask as in claim 1 further
2 comprising a memory connected to each of said backscatter electron detector and said secondary
3 electron detector to store said backscatter electron waveform and said secondary electron
4 waveform from said conductive optical mask.

1 5. (Unamended) A method for automatically inspecting an optical mask, said method
2 comprising the steps of:

3 a. applying a conductive coating to a top surface of said optical mask to produce a
4 conductive optical mask;

5 b. electrically grounding said conductive coating;

6 c. scanning an electron beam on a top surface of said conductive coating of step b.;

7 d. detecting backscattered electrons from said conductive coating of step c. to form a
8 backscatter electron waveform;

9 e. detecting secondary electrons from said conductive coating of step c. to form a
10 secondary electron waveform;

11 f. examining said backscatter electron waveform and said secondary electron waveform
12 from steps d, and e.; and

13 g. determining construction features of said conductive optical mask in response to step f.

1 6. (Unamended) A method for automatically inspecting an optical mask as in claim 5
2 wherein said optical mask is a phase shift mask.

1 7. (Unamended) A method for automatically inspecting an optical mask as in claim 5

2 wherein step a further includes the step of:

3 h. sputtering said coating onto said optical mask.

1 8. (Unamended) A method for automatically inspecting an optical mask as in claim 5 further

2 including the step of:

3 i. storing each of said backscatter electron waveform from step d. and said secondary

4 electron waveform from step e.

1 9. (Unamended) A method of inspecting a substrate, comprising:

2 a) exposing said substrate to a first group of electrons, said first group of electrons

3 causing said substrate to emit electrons; and

4 b) exposing said substrate to a second group of electrons, wherein said second group of

5 electrons reduces charging at a surface of said substrate, said charging resulting

6 from said emitted electrons.

1 10. (Unamended) The method of claim 9, wherein said substrate is a semiconductor wafer.

1 11. (Unamended) The method of claim 9, wherein said substrate includes an insulating

2 region.

1 12. (Unamended) The method of claim 9, further comprising detecting said emitted electrons.

1 13. (Unamended) The method of claim 12, wherein said emitted electrons are secondary

2 electrons.

- 1 14. (Unamended) The method of claim 12, wherein said emitted electrons are backscattered
2 electrons.
- 1 15. (Unamended) The method of claim 9, wherein said first group of electrons is provided in
2 the form of a beam incident upon said substrate.
- 1 16. (Unamended) The method of claim 9, wherein said second group of electrons are
2 electrons from the substrate that are caused to return to the substrate by an electrical field applied
3 to an electrode near the substrate.
- 1 17. (Unamended) The method of claim 9, wherein said substrate is maintained at a charge
2 equilibrium condition by the combination of said first group of electrons and said second group
3 of electrons.
- 1 18. (Unamended) The method of claim 17 wherein said charge equilibrium condition is set to
2 obtain favorable image statistics.
- 1 19. (Unamended) The method of claim 17 wherein said equilibrium condition is affected by
2 localized topographical and material differences on said substrate.
- 1 20. (Unamended) The method of claim 17 wherein surface charging creates a potential which
2 maintains said equilibrium condition.
- 1 21. (Unamended) The method of claim 9, wherein said charging is substantially caused by a
2 rate of electron emission from said surface that exceeds the rate at which said first group of
3 electrons arrives at said surface.

1 22. (Unamended) The method of claim 12, further comprising processing signals resulting
2 from said detected electrons.

1 23. (Unamended) The method of claim 22 wherein said signals are processed by comparison
2 with a reference to detect defects present on said substrate.

1 24. (Unamended) The method of claim 23 wherein said reference is derived from a
2 corresponding portion of said substrate.

1 25. (Unamended) The method of claim 23, wherein said reference is derived from a database
2 from which said substrate was designed.

1 26. (Unamended) The method of claim 9, wherein the first group of electrons has a high
2 landing energy.

1 27. (Amended) The method of claim 26, wherein the second group of electrons has a low
2 landing energy.

1 28. (Amended) The method of claim 27, wherein the second group of electrons is in the form
2 of a defocused beam.

1 29. (Unamended) The method of claim 9, wherein the second group of electrons is produced
2 by an intermediate electrode between a source of the electron beam and the substrate.

1 30. (Amended) The method of claim 9 wherein the first group of electrons is a charged
2 particle beam generated by a particle beam column which includes an aperture member to control
3 a current level and spot size of the electron beam.

1 31. (Canceled)

1 32. (Canceled)

1 33. (Amended) The system of claim 34 wherein the electron beam has a width in the range of
2 50nm - 2000nm.

1 34. (Amended) A system to automatically inspect a substrate, said system comprising:
2 an electron source to provide an electron beam at least 50nm wide;
3 a charged particle beam column to deliver and scan said electron beam;
4 an electron detector to detect electrons from said substrate as said electron beam scans
5 said substrate; and
6 a processor to examine an image from said detected electrons to determine features of
7 said substrate and wherein the processor further includes an image processor to
8 compare images from two different locations on the substrate and determine the
9 location of defects on the substrate when the comparison detects a difference.

1 35. (Amended) The system of claim 34 wherein the substrate is a photomask.

1 36. (Amended) The system of claim 34 wherein the substrate is a production wafer.

1 37. (Amended) A system to automatically inspect a substrate, said system comprising:
2 an electron source to provide an electron beam from a high brilliance source with an
3 irradiance of greater than 1 milli-amp per steradian;
4 a charged particle beam column to deliver and scan said electron beam;
5 an electron detector to detect electrons from said substrate as said electron beam scans
6 said substrate; and

7 a processor to examine an image from said detected electrons to determine features of
8 said substrate and wherein the processor further includes an image processor to
9 compare images from two different locations on the substrate and determine the
10 location of defects on the substrate when the comparison detects a difference.

1 38. (Unamended) The system of claim 37, wherein the beam produces an inspection spot on
2 the substrate which is at least 50nm in width.

1 39. (Unamended) The system of claim 38, wherein the electron source provides an electron
2 beam in the range of 50nm - 2000nm in width.

1 40. (Amended) A system to automatically inspect a substrate, said system comprising:
2 an electron source to provide an electron beam at least 50nm wide;
3 a charged particle beam column to deliver and scan said electron beam;
4 an electron detector to detect electrons from said substrate as said electron beam scans
5 said substrate, which is affixed to a stage;
6 a processor to examine an image from said detected electrons to determine features of
7 said substrate and wherein the processor further includes an image processor to
8 compare images from two different locations on the substrate and determine the
9 location of defects on the substrate when the comparison detects a difference; and
10 a subsystem to receive feedback about the position of the stage and to correct the position
11 of the electron beam with respect to the stage.

1 41. (Unamended) The system of claim 40, further comprising an interferometer used to track
2 the position of the stage.

1 42. (Amended) A system to automatically inspect a substrate, said system comprising:
2 an electron source to provide an electron beam;
3 a charged particle beam column to deliver and scan said electron beam;
4 an electron detector to detect non-reflected electrons from said substrate as said electron
5 beam scans said substrate; and
6 a processor to examine an image from said detected electrons to determine features of
7 said substrate and to compare the image to information from a database,
8 disagreement between the image and the information from the database indicating
9 a defect in the substrate.

1 43. (Unamended) The system of claim 42, wherein the beam produces an inspection spot on
2 the substrate which is at least 50nm in width.

1 44. (Unamended) The system of claim 43 wherein the inspection spot is in the range of 50nm
2 to 200nm.

1 45. (Unamended) The system of claim 42, wherein the database is a CAD database that
2 contains layout information for the pattern of the substrate under test.

1 46. (Unamended) The system of claim 42 wherein the substrate is a photomask.

1 47. (Unamended) The system of claim 42 wherein the substrate is a production wafer.

1 48. (Unamended) The system of claim 42, where the processor includes an alignment
2 processor to measure differences in alignment between a digitized version of the image and the
3 information from the database and then to use the alignment measurement to align the image and
4 the information from the database.

1 49. (Unamended) A method of automatically inspecting insulated surfaces of a substrate by
2 controlling the build up of surface charge on the substrate, comprising:
3 a) performing an electron beam inspection of the substrate in multiple swaths, an electron
4 beam dose per swath being selected to control the charge density;
5 b) performing repeated swaths for a pattern feature of the substrate so as that the resulting
6 multiple feature images are exactly aligned and can be overlaid precisely; and
7 c) averaging the multiple image features to maximize signal contrast in the image of the
8 pattern feature.

1 50. (Unamended) The method of claim 49, wherein the performing step includes performing
2 an electron beam inspection of the substrate in multiple swaths, an electron beam dose per swath
3 being selected to minimize the charge density.

1 51. (Unamended) The method of claim 49, wherein an image of a pattern feature is produced
2 by averaging between 2 to 256 inclusive repeated frames.

1 52. (Unamended) The method of claim 51, wherein a frame size varies in the range of 512 to
2 4096 pixels tall by 4 to 4096 pixels wide.

1 53. (Unamended) The method of claim 49 wherein the substrate is a photomask.

1 54. (Unamended) The method of claim 49 wherein the substrate is a production wafer.

1 55. (Amended) A system for automatically classifying defects in a substrate, said system
2 comprising:
3 a subsystem to provide a high energy electron beam and a low energy electron beam from
4 an electron source;

5 a charged particle beam column to deliver and scan said high energy and said low energy
6 electron beams;
7 an electron detector to detect non-reflected electrons from said substrate as one of said
8 high energy and said low energy electron beams scans said substrate; and
9 a processor to examine an image from said detected electrons to determine features of
10 said substrate.

1 56. (Canceled)

1 57. (Canceled)

1 58. (Canceled)

1 59. (Unamended) A method for inspecting insulating and thermally sensitive surfaces of a
2 substrate, comprising:

- 3 a) performing an electron beam inspection of the substrate in multiple swaths, an electron
4 beam dose per swath being selected to control thermal load per swath;
5 b) performing repeated swaths for a pattern region of the substrate so as that the resulting
6 multiple region images are exactly aligned and can be overlaid precisely; and
7 c) averaging the multiple region images to maximize signal contrast in the image of the
8 substrate.

1 60. (Unamended) The method of claim 59 wherein the substrate is a photomask.

1 61. (Unamended) The method of claim 59 wherein the substrate is a production wafer.

1 62. (New) The system of claim 55 wherein the subsystem provides the high energy electron
2 beam and the low energy electron beam non-simultaneously.